

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-229				Issued on Date	30/08/2023
Assessment Reference	As Built	Prop Type Ref	A End Op			
Property	11, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	87 B	DER	12.92	TER	18.80	
Environmental	90 B	% DER<TER	31.28			
CO ₂ Emissions (t/year)	0.78	DFEE	44.47	TFEE	52.37	
General Requirements Compliance	Pass	% DFEE<TFEE	15.09			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

End-Terrace House, total floor area 78 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.79 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North East: 0.60 m², No overhang
Windows facing South East: 3.33 m², No overhang
Windows facing North West: 5.33 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.66 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2825	0.2769	0.2714	0.2437	0.2382	0.2105	0.2105	0.2049	0.2215	0.2382	0.2492	0.2603 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5325	0.5269	0.5214	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5103 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.9013	Feb 34.5383	Mar 34.1752	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 33.4492 (38)
Heat transfer coeff	85.9193	85.5563	85.1932	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	84.4672 (39)
Average = Sum(39)m / 12 =												84.2891 (39)
HLP	Jan 1.0987	Feb 1.0941	Mar 1.0894	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0801 (40)
HLP (average)												1.0779 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4011	19.0083	15.4586	11.7031	8.7482	7.3856	7.9804	10.3733	13.9230	17.6784	20.6333	21.9959 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	371.1682	368.8842	355.2774	333.5134	311.5063	290.4138	276.8325	282.9636	294.2776	316.2515	341.3769	360.1316 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.7200	0.7000	0.7700	2.3645 (75)
Southeast	3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (77)
Northwest	1.5300	11.2829	0.7200	0.7000	0.7700	6.0294 (81)
Northwest	3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)

Solar gains	66.1631	120.4624	185.4398	264.3277	327.6128	339.1186	321.1724	271.8377	212.4244	138.6957	80.6617	55.7071 (83)
Total gains	437.3313	489.3465	540.7173	597.8411	639.1190	629.5325	598.0049	554.8013	506.7020	454.9472	422.0386	415.8387 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.5885	24.6928	24.7981	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.0112
alpha	2.6392	2.6462	2.6532	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6674
util living area	0.9694	0.9573	0.9340	0.8838	0.7959	0.6677	0.5388	0.5865	0.7744	0.9079	0.9570	0.9729 (86)
MIT	18.6085	18.8460	19.2666	19.8401	20.3536	20.7230	20.8889	20.8566	20.5562	19.9049	19.1824	18.5840 (87)
Th 2	20.0019	20.0057	20.0095	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0171 (88)
util rest of house	0.9649	0.9510	0.9237	0.8646	0.7593	0.6020	0.4424	0.4921	0.7208	0.8887	0.9496	0.9690 (89)
MIT 2	16.7894	17.1354	17.7447	18.5712	19.2817	19.7599	19.9460	19.9169	19.5652	18.6758	17.6373	16.7623 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	16.9779	17.3126	17.9024	18.7026	19.3927	19.8596	20.0437	20.0142	19.6679	18.8031	17.7973	16.9510 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8279	17.1626	17.7524	18.5526	19.2427	19.7096	19.8937	19.8642	19.5179	18.6531	17.6473	16.8010 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9427	0.9244	0.8911	0.8272	0.7242	0.5780	0.4283	0.4748	0.6872	0.8521	0.9229	0.9487 (94)
Ext temp.	412.2863	452.3518	481.8554	494.5239	462.8766	363.8674	256.1337	263.4254	348.1994	387.6683	389.4958	394.5050 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1076.3845	1049.1400	958.6259	808.8105	632.0156	428.1446	275.9831	290.2739	453.9713	674.7856	883.7761	1064.3698 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	494.0891	401.0417	354.7173	226.2863	125.8395	0.0000	0.0000	0.0000	0.0000	213.6152	355.8818	498.3795 (98)
Space heating per m2												2669.8504 (98)
										(98) / (4) =		34.1413 (99)

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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	2950.1109 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	494.0891	401.0417	354.7173	226.2863	125.8395	0.0000	0.0000	0.0000	0.0000	213.6152	355.8818	498.3795 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	545.9548	443.1400	391.9528	250.0401	139.0492	0.0000	0.0000	0.0000	0.0000	236.0389	393.2396	550.6955 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Efficiency of water heater (217)m	89.6809	89.6329	89.5279	89.2971	88.8631	87.3000	87.3000	87.3000	87.3000	89.2251	89.5394	87.3000 (216)
Fuel for water heating, kWh/month	182.8323	160.4220	166.7661	147.2324	143.0576	127.3000	119.5890	134.9162	135.8416	152.9361	164.4664	177.5019 (219)
Water heating fuel used												1812.8616 (219)
Annual totals kWh/year												
Space heating fuel - main system												2950.1109 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												55.2921 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												130.2921 (231)
Electricity for lighting (calculated in Appendix L)												377.9500 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =												-543.4106 (233)
Total delivered energy for all uses												4727.8041 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2950.1109	0.2160	637.2240 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1812.8616	0.2160	391.5781 (264)
Space and water heating			1028.8021 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	377.9500	0.5190	196.1561 (268)
Energy saving/generation technologies			
PV Unit	-543.4106	0.5190	-282.0301 (269)
Total CO2, kg/year			1010.5496 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.9200 ZC1
Total Floor Area	TFA	78.2000
Assumed number of occupants	N	2.4278
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.3404 ZC2
CO2 emissions from cooking, equation (L16)		2.2669 ZC3
Total CO2 emissions		31.5273 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		31.5273 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1510 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4010 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3710 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359	(22b)				
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.2600	1.3258	12.2765		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1800	14.1642		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.7267		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9142 (36)					
Total fabric heat loss						(33) + (36) =	47.6409 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1052	Feb 39.8205	Mar 39.5414	Apr 38.2307	May 37.9855	Jun 36.8439	Jul 36.8439	Aug 36.6325	Sep 37.2836	Oct 37.9855	Nov 38.4816	Dec 39.0002 (38)
Heat transfer coeff	87.7461	87.4614	87.1823	85.8716	85.6264	84.4848	84.4848	84.2734	84.9245	85.6264	86.1225	86.6411 (39)
Average = Sum(39)m / 12 =												85.8704 (39)
HLP	Jan 1.1221	Feb 1.1184	Mar 1.1149	Apr 1.0981	May 1.0950	Jun 1.0804	Jul 1.0804	Aug 1.0777	Sep 1.0860	Oct 1.0950	Nov 1.1013	Dec 1.1079 (40)
HLP (average)												1.0981 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum(45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.8180	47.7474	44.3952	44.0025	40.7711	42.1301	44.0025	44.3952	47.7474	48.0193	50.9589 (61)
Solar input	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (64)
	62.5647	54.7817	56.9047	50.3028	48.6178	42.6535	40.6122	45.5175	46.0279	52.6434	56.4391	60.9925 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4011	19.0083	15.4586	11.7031	8.7482	7.3856	7.9804	10.3733	13.9230	17.6784	20.6333	21.9959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	84.0923	81.5204	76.4847	69.8650	65.3465	59.2410	54.5863	61.1794	63.9276	70.7572	78.3877	81.9792	(72)
Total internal gains	383.5482	380.8211	366.5969	344.2174	321.5908	299.8807	286.3063	293.0546	304.9913	327.5806	353.3193	372.5154	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				0.6000	11.2829	0.6300	0.7000	0.7700	2.0689 (75)				
Southeast				3.3300	36.7938	0.6300	0.7000	0.7700	37.4448 (77)				
Northwest				5.3300	11.2829	0.6300	0.7000	0.7700	18.3790 (81)				
Solar gains	57.8927	105.4046	162.2599	231.2868	286.6612	296.7288	281.0259	237.8580	185.8713	121.3588	70.5790	48.7437	(83)
Total gains	441.4408	486.2257	528.8568	575.5042	608.2519	596.6095	567.3321	530.9126	490.8626	448.9394	423.8983	421.2591	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8894	62.0909	62.2896	63.2404	63.4215	64.2785	64.2785	64.4397	63.9457	63.4215	63.0562	62.6787	
alpha	5.1260	5.1394	5.1526	5.2160	5.2281	5.2852	5.2852	5.2960	5.2630	5.2281	5.2037	5.1786	
util living area	0.9985	0.9972	0.9934	0.9790	0.9290	0.7968	0.6292	0.6869	0.9047	0.9860	0.9971	0.9988	(86)
MIT	19.7632	19.8848	20.1071	20.4233	20.7194	20.9206	20.9821	20.9721	20.8275	20.4567	20.0616	19.7476	(87)
Th 2	19.9828	19.9858	19.9887	20.0024	20.0049	20.0169	20.0169	20.0191	20.0123	20.0049	19.9998	19.9944	(88)
util rest of house	0.9980	0.9963	0.9910	0.9702	0.8973	0.7128	0.5017	0.5611	0.8497	0.9786	0.9959	0.9984	(89)
MIT 2	18.3288	18.5085	18.8346	19.3009	19.7111	19.9592	20.0097	20.0064	19.8610	19.3547	18.7773	18.3142	(90)
Living area fraction	18.4774	18.6511	18.9664	19.4172	19.8156	20.0588	20.1104	20.1065	19.9611	19.4688	18.9103	18.4627	(91)
MIT	18.4774	18.6511	18.9664	19.4172	19.8156	20.0588	20.1104	20.1065	19.9611	19.4688	18.9103	18.4627	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4774	18.6511	18.9664	19.4172	19.8156	20.0588	20.1104	20.1065	19.9611	19.4688	18.9103	18.4627	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9943	0.9873	0.9632	0.8898	0.7169	0.5145	0.5732	0.8461	0.9728	0.9938	0.9975	(94)
Useful gains	440.0320	483.4577	522.1413	554.3151	541.1923	427.6995	291.9046	304.3245	415.3335	436.7216	421.2862	420.2029	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1244.0093	1202.6876	1086.8536	903.1276	694.9080	461.1872	296.5760	312.3563	497.7508	759.4038	1017.1355	1235.7376	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	598.1591	483.3225	420.1459	251.1450	114.3644	0.0000	0.0000	0.0000	0.0000	240.0755	429.0115	606.7578	(98)
Space heating												3142.9818	(98)
Space heating per m2												40.1916	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3365.0769 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.1591	483.3225	420.1459	251.1450	114.3644	0.0000	0.0000	0.0000	0.0000	240.0755	429.0115	606.7578 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	640.4273	517.4759	449.8351	268.8918	122.4459	0.0000	0.0000	0.0000	0.0000	257.0402	459.3271	649.6336 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (64)
Efficiency of water heater (217)m	87.6298	87.4648	87.0771	86.1465	84.2657	80.3000	80.3000	80.3000	80.3000	85.9174	87.1396	80.3000 (216)
Fuel for water heating, kWh/month	229.1554	201.0834	210.1459	188.4023	186.4779	172.3505	165.1249	184.0755	186.1085	198.0659	208.4658	223.5659 (219)
Water heating fuel used												2353.0217 (219)
Annual totals kWh/year												
Space heating fuel - main system												3365.0769 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												377.9500 (232)
Total delivered energy for all uses												6171.0486 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3365.0769	0.2160	726.8566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2353.0217	0.2160	508.2527 (264)
Space and water heating			1235.1093 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.9500	0.5190	196.1561 (268)
Total CO2, kg/m2/year			1470.1904 (272)
Emissions per m2 for space and water heating			15.7942 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5084 (272b)
Emissions per m2 for pumps and fans			0.4978 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7942 * 1.00) + 2.5084 + 0.4978, rounded to 2 d.p.			18.8000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1510 (8)
Pressure test										Yes							
Measured/design AP50										4.7900							
Infiltration rate										0.3905 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3612 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4606	0.4516	0.4425	0.3974	0.3883	0.3432	0.3432	0.3342	0.3612	0.3883	0.4064	0.4245	(22b)				
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5652	0.5754	0.5826	0.5901	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)
Total net area of external elements Aum, m ²			168.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9316		(33)
Timber Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)
Timber GF			62.6100			9.0000	563.4900 (32c)
Timber FF			75.8400			9.0000	682.5600 (32c)
Internal Floor			39.1000			18.0000	703.8000 (32d)
Internal Ceiling			39.1000			9.0000	351.9000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7253.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.7565 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)
Total fabric heat loss					(33) + (36) =		51.0180 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.7263	39.4563	39.1917	37.9487	37.7161	36.6335	36.6335	36.4331	37.0505	37.7161	38.1866	38.6784 (38)
Heat transfer coeff	90.7443	90.4743	90.2096	88.9667	88.7341	87.6515	87.6515	87.4510	88.0685	88.7341	89.2046	89.6964 (39)
Average = Sum(39)m / 12 =												88.9656 (39)
HLP	1.1604	1.1570	1.1536	1.1377	1.1347	1.1209	1.1209	1.1183	1.1262	1.1347	1.1407	1.1470 (40)
HLP (average)												1.1377 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1445.3269 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4011	19.0083	15.4586	11.7031	8.7482	7.3856	7.9804	10.3733	13.9230	17.6784	20.6333	21.9959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.2556	337.7443	325.7396	306.1513	285.5575	266.4530	254.5585	258.5253	269.0680	288.7904	311.3731	328.9854	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				0.6000	11.2829		0.7200		0.7000		0.7700		2.3645 (75)
Southeast				3.3300	36.7938		0.7200		0.7000		0.7700		42.7940 (77)
Northwest				1.5300	11.2829		0.7200		0.7000		0.7700		6.0294 (81)
Northwest				3.8000	11.2829		0.7200		0.7000		0.7700		14.9751 (81)
Solar gains	66.1631	120.4624	185.4398	264.3277	327.6128	339.1186	321.1724	271.8377	212.4244	138.6957	80.6617	55.7071	(83)
Total gains	405.4186	458.2067	511.1794	570.4790	613.1702	605.5717	575.7309	530.3630	481.4924	427.4861	392.0348	384.6925	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.2039	22.2702	22.3355	22.6476	22.7069	22.9874	22.9874	23.0401	22.8785	22.7069	22.5872	22.4633	
alpha	2.4803	2.4847	2.4890	2.5098	2.5138	2.5325	2.5325	2.5360	2.5252	2.5138	2.5058	2.4976	
util living area	0.9719	0.9606	0.9389	0.8930	0.8120	0.6890	0.5640	0.6128	0.7939	0.9169	0.9611	0.9752	(86)
MIT	18.3314	18.5780	19.0245	19.6394	20.2137	20.6530	20.8528	20.8133	20.4569	19.7248	18.9312	18.2937	(87)
Th 2	19.9518	19.9546	19.9573	19.9702	19.9726	19.9838	19.9838	19.9859	19.9795	19.9726	19.9677	19.9626	(88)
util rest of house	0.9677	0.9547	0.9293	0.8747	0.7765	0.6231	0.4637	0.5157	0.7419	0.8990	0.9543	0.9715	(89)
MIT 2	17.5055	17.7515	18.1945	18.8044	19.3530	19.7555	19.9122	19.8891	19.5925	18.8981	18.1133	17.4754	(90)
Living area fraction	17.5910	17.8371	18.2805	18.8908	19.4421	19.8485	20.0097	19.9848	19.6821	18.9837	18.1980	17.5601	(92)
Temperature adjustment	17.5910	17.8371	18.2805	18.8908	19.4421	19.8485	20.0097	19.9848	19.6821	18.9837	18.1980	17.5601	(93)
adjusted MIT	17.5910	17.8371	18.2805	18.8908	19.4421	19.8485	20.0097	19.9848	19.6821	18.9837	18.1980	17.5601	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	386.9888	430.0105	464.6434	485.3974	462.8204	371.3220	268.5573	273.4719	348.4728	374.7948	367.8538	369.1064	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1206.0838	1170.4782	1062.7118	888.8520	686.9900	460.0361	298.8621	313.4981	491.6042	743.9210	989.9929	1198.3572	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	609.4067	497.5943	444.9629	290.4874	166.7822	0.0000	0.0000	0.0000	0.0000	274.6299	447.9401	616.9626	(98)
Space heating													3348.7661 (98)
Space heating per m2													42.8231 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	823.9243	648.6212	664.6279	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7059	0.7722	0.7411	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	581.6090	500.8718	492.5485	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	799.1812	762.5165	711.3065	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	156.6520	194.6637	162.7559	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			514.0716 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.1630	48.6659	40.6890	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												128.5179 (107)
Energy for space heating												1.6435 (108)
Energy for space cooling												42.8231 (99)
Total												1.6435 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.4665 (109)
												44.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
														Air changes per hour			
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1510 (8)	
Pressure test														Yes			
Measured/design AP50																5.0000	
Infiltration rate																0.4010 (18)	
Number of sides sheltered																1 (19)	
Shelter factor														(20) = 1 - [0.075 x (19)] =		0.9250 (20)	
Infiltration rate adjusted to include shelter factor														(21) = (18) x (20) =		0.3710 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359 (22b)					
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.2600	1.3258	12.2765		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1800	14.1642		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7267		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9142 (36)					
Total fabric heat loss						(33) + (36) =	47.6409 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1052	Feb 39.8205	Mar 39.5414	Apr 38.2307	May 37.9855	Jun 36.8439	Jul 36.8439	Aug 36.6325	Sep 37.2836	Oct 37.9855	Nov 38.4816	Dec 39.0002 (38)
Heat transfer coeff	87.7461	87.4614	87.1823	85.8716	85.6264	84.4848	84.4848	84.2734	84.9245	85.6264	86.1225	86.6411 (39)
Average = Sum(39)m / 12 =												85.8704 (39)
HLP	Jan 1.1221	Feb 1.1184	Mar 1.1149	Apr 1.0981	May 1.0950	Jun 1.0804	Jul 1.0804	Aug 1.0777	Sep 1.0860	Oct 1.0950	Nov 1.1013	Dec 1.1079 (40)
HLP (average)												1.0981 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum(45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4011	19.0083	15.4586	11.7031	8.7482	7.3856	7.9804	10.3733	13.9230	17.6784	20.6333	21.9959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.2556	337.7443	325.7396	306.1513	285.5575	266.4530	254.5585	258.5253	269.0680	288.7904	311.3731	328.9854	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast				0.6000	11.2829	0.6300	0.7000			0.7700			2.0689 (75)
Southeast				3.3300	36.7938	0.6300	0.7000			0.7700			37.4448 (77)
Northwest				5.3300	11.2829	0.6300	0.7000			0.7700			18.3790 (81)
Solar gains	57.8927	105.4046	162.2599	231.2868	286.6612	296.7288	281.0259	237.8580	185.8713	121.3588	70.5790	48.7437	(83)
Total gains	397.1483	443.1489	487.9995	537.4381	572.2186	563.1818	535.5844	496.3832	454.9393	410.1492	381.9521	377.7291	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8894	62.0909	62.2896	63.2404	63.4215	64.2785	64.2785	64.4397	63.9457	63.4215	63.0562	62.6787	
alpha	5.1260	5.1394	5.1526	5.2160	5.2281	5.2852	5.2852	5.2960	5.2630	5.2281	5.2037	5.1786	
util living area	0.9991	0.9982	0.9954	0.9842	0.9427	0.8233	0.6598	0.7224	0.9258	0.9906	0.9982	0.9993	(86)
MIT	19.7101	19.8334	20.0592	20.3816	20.6883	20.9063	20.9777	20.9646	20.7997	20.4126	20.0114	19.6952	(87)
Th 2	19.9828	19.9858	19.9887	20.0024	20.0049	20.0169	20.0169	20.0191	20.0123	20.0049	19.9998	19.9944	(88)
util rest of house	0.9988	0.9976	0.9937	0.9774	0.9154	0.7428	0.5293	0.5956	0.8787	0.9854	0.9975	0.9991	(89)
MIT 2	18.8005	18.9260	19.1534	19.4834	19.7777	19.9691	20.0106	20.0077	19.8879	19.5183	19.1152	18.7949	(90)
Living area fraction									fLA = Living area / (4) =			0.1036	(91)
MIT	18.8948	19.0200	19.2472	19.5764	19.8721	20.0662	20.1108	20.1069	19.9824	19.6109	19.2081	18.8882	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8948	19.0200	19.2472	19.5764	19.8721	20.0662	20.1108	20.1069	19.9824	19.6109	19.2081	18.8882	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9967	0.9919	0.9735	0.9109	0.7474	0.5427	0.6081	0.8769	0.9824	0.9966	0.9987	(94)
Ext temp.	396.4696	441.6807	484.0333	523.2061	521.2293	420.9479	290.6361	301.8516	398.9373	402.9484	380.6490	377.2363	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1280.6331	1234.9565	1111.3339	916.7999	699.7443	461.8074	296.6063	312.3889	499.5587	771.5716	1042.7767	1272.6008	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	657.8177	533.0813	466.7116	283.3875	132.8152	0.0000	0.0000	0.0000	0.0000	274.2556	476.7320	666.1512	(99)
										(98) / (4) =		44.6413	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	794.1571	625.1875	640.4778	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8157	0.8918	0.8604	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	647.7764	557.5708	551.0814	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	749.6347	715.5920	671.5899	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.3379	117.5677	89.6583	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												280.5640	(104)

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	18.3345	29.3919	22.4146	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												70.1410 (107)
Space cooling per m2												0.8969 (108)
Energy for space heating												44.6413 (99)
Energy for space cooling												0.8969 (108)
Total												45.5383 (109)
Target Fabric Energy Efficiency (TFEE)												52.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2437	0.2271	0.2271	0.2160	0.2160	0.2049	0.2049	0.1938	0.1938	0.2105	0.2049	0.2160 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916 (39)
Average = Sum(39)m / 12 =												83.7916 (39)
HLP	Jan 1.0715	Feb 1.0715	Mar 1.0715	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0715 (40)
HLP (average)												1.0715 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
RHI water heating demand												1611 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5027	47.5207	38.6464	29.2578	21.8706	18.4640	19.9510	25.9331	34.8074	44.1960	51.5832	54.9897 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	550.6132	545.8420	524.1334	490.8236	456.9206	426.7696	409.3942	418.0124	437.4283	470.9479	507.9692	535.7825 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				0.6000	14.6176	0.7200	0.7000	0.7700	3.0633 (75)			
Southeast				3.3300	45.1778	0.7200	0.7000	0.7700	52.5452 (77)			
Northwest				1.5300	14.6176	0.7200	0.7000	0.7700	7.8115 (81)			
Northwest				3.8000	14.6176	0.7200	0.7000	0.7700	19.4010 (81)			
Solar gains	82.8211	128.9573	201.5663	290.7831	341.5173	387.6379	354.1942	312.5332	242.7267	158.5931	100.7746	65.9282 (83)
Total gains	633.4342	674.7993	725.6997	781.6067	798.4379	814.4075	763.5884	730.5456	680.1550	629.5410	608.7439	601.7107 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129
Feb	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809
Mar	0.9206	0.9040	0.8627	0.7853	0.6570	0.4759	0.3466	0.3606	0.5908	0.7903	0.8886	0.9275 (86)
Apr	19.2703	19.4346	19.8133	20.2643	20.6719	20.9050	20.9717	20.9688	20.8190	20.3870	19.7700	19.2305 (87)
May	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242 (88)
Jun	0.9097	0.8909	0.8434	0.7540	0.6046	0.3987	0.2501	0.2609	0.5160	0.7518	0.8707	0.9173 (89)
Jul	17.7527	17.9866	18.5230	19.1472	19.6831	19.9511	20.0111	20.0096	19.8671	19.3277	18.4707	17.6971 (90)
Aug	17.9099	18.1366	18.6567	19.2629	19.7855	20.0499	20.1106	20.1090	19.9657	19.4374	18.6053	17.8559 (92)
Sep	17.7599	17.9866	18.5067	19.1129	19.6355	19.8999	19.9606	19.9590	19.8157	19.2874	18.4553	17.7059 (93)
Oct												
Nov												
Dec												

8. Space heating requirement

Utilisation	0.8757	0.8551	0.8060	0.7198	0.5814	0.3882	0.2436	0.2539	0.4984	0.7171	0.8336	0.8843 (94)
Useful gains	554.6940	577.0399	584.9048	562.5814	464.2016	316.1895	186.0036	185.5031	338.9742	451.4565	507.4506	532.0833 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1035.6545	1012.7534	913.8882	763.5863	547.6233	335.1622	189.4161	189.2829	378.3777	610.6221	842.5482	1022.7551 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	357.8346	292.7995	244.7637	144.7236	62.0657	0.0000	0.0000	0.0000	0.0000	118.4192	241.2703	365.0599 (98)
Space heating												1826.9365 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1827 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2825	0.2769	0.2714	0.2437	0.2382	0.2105	0.2105	0.2049	0.2215	0.2382	0.2492	0.2603 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5325	0.5269	0.5214	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5103 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.9013	Feb 34.5383	Mar 34.1752	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 33.4492 (38)
Heat transfer coeff	85.9193	85.5563	85.1932	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	84.4672 (39)
Average = Sum(39)m / 12 =												84.2891 (39)
HLP	Jan 1.0987	Feb 1.0941	Mar 1.0894	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0801 (40)
HLP (average)												1.0779 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum (45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
										Total per year (kWh/year) = Sum (64)m =		1610.5098 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5027	47.5207	38.6464	29.2578	21.8706	18.4640	19.9510	25.9331	34.8074	44.1960	51.5832	54.9897 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	550.6132	545.8420	524.1334	490.8236	456.9206	426.7696	409.3942	418.0124	437.4283	470.9479	507.9692	535.7825 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.7200	0.7000	0.7700	2.3645 (75)
Southeast	3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (77)
Northwest	1.5300	11.2829	0.7200	0.7000	0.7700	6.0294 (81)
Northwest	3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)

Solar gains	66.1631	120.4624	185.4398	264.3277	327.6128	339.1186	321.1724	271.8377	212.4244	138.6957	80.6617	55.7071 (83)
Total gains	616.7762	666.3044	709.5733	755.1514	784.5334	765.8882	730.5666	689.8502	649.8527	609.6436	588.6309	591.4896 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.5885	24.6928	24.7981	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.0112
alpha	2.6392	2.6462	2.6532	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6674
util living area	0.9356	0.9187	0.8874	0.8250	0.7259	0.5897	0.4612	0.5001	0.6845	0.8424	0.9136	0.9411 (86)
MIT	18.9707	19.1864	19.5624	20.0662	20.4988	20.7978	20.9241	20.9033	20.6815	20.1451	19.5023	18.9462 (87)
Th 2	20.0019	20.0057	20.0095	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0171 (88)
util rest of house	0.9270	0.9078	0.8718	0.7998	0.6842	0.5236	0.3726	0.4115	0.6246	0.8145	0.9004	0.9332 (89)
MIT 2	17.3084	17.6196	18.1590	18.8760	19.4619	19.8372	19.9728	19.9549	19.7074	18.9985	18.0894	17.2823 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	17.4806	17.7819	18.3043	18.9992	19.5693	19.9367	20.0713	20.0531	19.8083	19.1173	18.2357	17.4546 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3306	17.6319	18.1543	18.8492	19.4193	19.7867	19.9213	19.9031	19.6583	18.9673	18.0857	17.3046 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8949	0.8731	0.8345	0.7633	0.6549	0.5061	0.3627	0.3997	0.5990	0.7770	0.8653	0.9027 (94)
Ext temp.	551.9471	581.7557	592.1110	576.3851	513.7564	387.6053	264.9564	275.6991	389.2860	473.7114	509.3340	533.9478 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1119.5789	1089.2958	992.8701	833.6632	646.8119	434.5997	278.2973	293.5306	465.7417	701.1098	920.5133	1106.9093 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	422.3181	341.0669	298.1648	185.2403	98.9932	0.0000	0.0000	0.0000	0.0000	169.1844	296.0491	426.2833 (98)
Space heating per m ²												2237.3002 (98)
										(98) / (4) =		28.6100 (99)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2472.1549 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	422.3181	341.0669	298.1648	185.2403	98.9932	0.0000	0.0000	0.0000	0.0000	169.1844	296.0491	426.2833	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	466.6498	376.8695	329.4639	204.6854	109.3848	0.0000	0.0000	0.0000	0.0000	186.9441	327.1261	471.0313	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater (217)m	89.5817	89.5268	89.4065	89.1436	88.6727	87.3000	87.3000	87.3000	87.3000	89.0428	89.4113	87.3000	(216)
Fuel for water heating, kWh/month	183.0349	160.6121	166.9925	147.4861	143.3648	127.3000	119.5890	134.9162	135.8416	153.2493	164.7020	177.6942	(219)
Water heating fuel used												1814.7826	(219)
Annual totals kWh/year													
Space heating fuel - main system												2472.1549	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												55.2921	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												130.2921	(231)
Electricity for lighting (calculated in Appendix L)												377.9500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =										-543.4106		-543.4106	(233)
Total delivered energy for all uses												4251.7691	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2472.1549	3.4800	86.0310	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.7826	3.4800	63.1544	(247)
Mechanical ventilation fans	55.2921	13.1900	7.2930	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	377.9500	13.1900	49.8516	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-543.4106	13.1900	-71.6759	(252)
Total energy cost			264.5467	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9019	(257)
SAP value		87.4190	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2472.1549	0.2160	533.9855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.7826	0.2160	391.9930	(264)
Space and water heating			925.9785	(265)
Pumps and fans	130.2921	0.5190	67.6216	(267)
Energy for lighting	377.9500	0.5190	196.1561	(268)
Energy saving/generation technologies				
PV Unit	-543.4106	0.5190	-282.0301	(269)
Total kg/year			907.7261	(272)
CO2 emissions per m2			11.6100	(273)
EI value			90.1270	

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EI rating
EI band

90 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8863 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8863 = 0.2437$, stars = 4

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2437	0.2271	0.2271	0.2160	0.2160	0.2049	0.2049	0.1938	0.1938	0.2105	0.2049	0.2160 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916 (39)
Average = Sum(39)m / 12 =												83.7916 (39)
HLP	Jan 1.0715	Feb 1.0715	Mar 1.0715	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0715 (40)
HLP (average)												1.0715 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5027	47.5207	38.6464	29.2578	21.8706	18.4640	19.9510	25.9331	34.8074	44.1960	51.5832	54.9897 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	550.6132	545.8420	524.1334	490.8236	456.9206	426.7696	409.3942	418.0124	437.4283	470.9479	507.9692	535.7825 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	14.6176	0.7200	0.7000	0.7700	3.0633 (75)
Southeast	3.3300	45.1778	0.7200	0.7000	0.7700	52.5452 (77)
Northwest	1.5300	14.6176	0.7200	0.7000	0.7700	7.8115 (81)
Northwest	3.8000	14.6176	0.7200	0.7000	0.7700	19.4010 (81)

Solar gains	82.8211	128.9573	201.5663	290.7831	341.5173	387.6379	354.1942	312.5332	242.7267	158.5931	100.7746	65.9282 (83)
Total gains	633.4342	674.7993	725.6997	781.6067	798.4379	814.4075	763.5884	730.5456	680.1550	629.5410	608.7439	601.7107 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129
alpha	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809
util living area	0.9206	0.9040	0.8627	0.7853	0.6570	0.4759	0.3466	0.3606	0.5908	0.7903	0.8886	0.9275 (86)
MIT	19.2703	19.4346	19.8133	20.2643	20.6719	20.9050	20.9717	20.9688	20.8190	20.3870	19.7700	19.2305 (87)
Th 2	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242 (88)
util rest of house	0.9097	0.8909	0.8434	0.7540	0.6046	0.3987	0.2501	0.2609	0.5160	0.7518	0.8707	0.9173 (89)
MIT 2	17.7527	17.9866	18.5230	19.1472	19.6831	19.9511	20.0111	20.0096	19.8671	19.3277	18.4707	17.6971 (90)
Living area fraction	17.9099	18.1366	18.6567	19.2629	19.7855	20.0499	20.1106	20.1090	19.9657	19.4374	18.6053	17.8559 (91)
MIT	17.9099	18.1366	18.6567	19.2629	19.7855	20.0499	20.1106	20.1090	19.9657	19.4374	18.6053	17.8559 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7599	17.9866	18.5067	19.1129	19.6355	19.8999	19.9606	19.9590	19.8157	19.2874	18.4553	17.7059 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8757	0.8551	0.8060	0.7198	0.5814	0.3882	0.2436	0.2539	0.4984	0.7171	0.8336	0.8843 (94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1035.6545	1012.7534	913.8882	763.5863	547.6233	335.1622	189.4161	189.2829	378.3777	610.6221	842.5482	1022.7551 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	357.8346	292.7995	244.7637	144.7236	62.0657	0.0000	0.0000	0.0000	0.0000	118.4192	241.2703	365.0599 (98)
Space heating												1826.9365 (98)
Space heating per m2												23.3624 (99)

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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2018.7144 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	357.8346	292.7995	244.7637	144.7236	62.0657	0.0000	0.0000	0.0000	0.0000	118.4192	241.2703	365.0599	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	395.3974	323.5353	270.4571	159.9155	68.5809	0.0000	0.0000	0.0000	0.0000	130.8500	266.5970	403.3810	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater (217)m	89.4695	89.4205	89.2604	88.9480	88.3246	87.3000	87.3000	87.3000	87.3000	88.7581	89.2599	87.3000	(216)
Fuel for water heating, kWh/month	183.2644	160.8031	167.2659	147.8103	143.9298	127.3000	119.5890	134.9162	135.8416	153.7407	164.9813	177.8990	(219)
Water heating fuel used												1817.3414	(219)
Annual totals kWh/year													
Space heating fuel - main system												2018.7144	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												55.2921	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												130.2921	(231)
Electricity for lighting (calculated in Appendix L)												377.9500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1149 * 1.00) =										-606.6838		-606.6838	(233)
Total delivered energy for all uses												3737.6142	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2018.7144	10.2300	206.5145 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1817.3414	10.2300	185.9140 (247)
Mechanical ventilation fans	55.2921	36.7200	20.3033 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	377.9500	36.7200	138.7832 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-606.6838	36.7200	-222.7743 (252)
Total energy cost			459.2807 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2018.7144	0.2160	436.0423 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1817.3414	0.2160	392.5457 (264)
Space and water heating			828.5881 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	377.9500	0.5190	196.1561 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	0.5190	-314.8689 (269)
Total kg/year			777.4969 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2018.7144	1.2200	2462.8316 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1817.3414	1.2200	2217.1565 (264)
Space and water heating			4679.9881 (265)
Pumps and fans	130.2921	3.0700	399.9969 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy for lighting	377.9500	3.0700	1160.3065 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	3.0700	-1862.5192 (269)
Primary energy kWh/year			4377.7723 (272)
Primary energy kWh/m2/year			55.9817 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 81	-184 kg (23.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 2.35 kg/m²	B 89	A 92
Total Savings	£81 2.35 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£187	£205	-£18
Mains gas	£495	£396	£99
Space heating	£357	£357	£0
Water heating	£186	£105	£81
Lighting	£139	£139	£0
Generated (PV)	-£223	-£223	£0
Total cost of fuels	£459	£378	£81
Total cost of uses	£459	£378	£81
Delivered energy	48 kWh/m²	36 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	43 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2825	0.2769	0.2714	0.2437	0.2382	0.2105	0.2105	0.2049	0.2215	0.2382	0.2492	0.2603 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5325	0.5269	0.5214	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5103 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.9013	Feb 34.5383	Mar 34.1752	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 33.4492 (38)
Heat transfer coeff	85.9193	85.5563	85.1932	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	84.4672 (39)
Average = Sum(39)m / 12 =												84.2891 (39)
HLP	Jan 1.0987	Feb 1.0941	Mar 1.0894	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0801 (40)
HLP (average)												1.0779 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2548 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-840.4246 (H17)
Solar input	-24.3706	-40.6676	-69.2616	-92.8241	-114.6764	-112.7452	-111.2552	-97.2042	-76.1304	-51.9881	-28.9071	-20.3941 (63)
Solar input (sum of months) = Sum (63)m =												-840.4246 (63)
Output from w/h	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320 (64)
Total per year (kWh/year) = Sum (64)m =												778.5514 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5027	47.5207	38.6464	29.2578	21.8706	18.4640	19.9510	25.9331	34.8074	44.1960	51.5832	54.9897 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	550.6132	545.8420	524.1334	490.8236	456.9206	426.7696	409.3942	418.0124	437.4283	470.9479	507.9692	535.7825 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast												0.6000	11.2829		0.7200	0.7000	0.7700	2.3645 (75)				
Southeast												3.3300	36.7938		0.7200	0.7000	0.7700	42.7940 (77)				
Northwest												1.5300	11.2829		0.7200	0.7000	0.7700	6.0294 (81)				
Northwest												3.8000	11.2829		0.7200	0.7000	0.7700	14.9751 (81)				
Solar gains	66.1631	120.4624	185.4398	264.3277	327.6128	339.1186	321.1724	271.8377	212.4244	138.6957	80.6617	55.7071 (83)										
Total gains	616.7762	666.3044	709.5733	755.1514	784.5334	765.8882	730.5666	689.8502	649.8527	609.6436	588.6309	591.4896 (84)										

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.5885	24.6928	24.7981	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.0112
alpha	2.6392	2.6462	2.6532	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6674
util living area	0.9356	0.9187	0.8874	0.8250	0.7259	0.5897	0.4612	0.5001	0.6845	0.8424	0.9136	0.9411 (86)
MIT	18.9707	19.1864	19.5624	20.0662	20.4988	20.7978	20.9241	20.9033	20.6815	20.1451	19.5023	18.9462 (87)
Th 2	20.0019	20.0057	20.0095	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0171 (88)
util rest of house	0.9270	0.9078	0.8718	0.7998	0.6842	0.5236	0.3726	0.4115	0.6246	0.8145	0.9004	0.9332 (89)
MIT 2	17.3084	17.6196	18.1590	18.8760	19.4619	19.8372	19.9728	19.9549	19.7074	18.9985	18.0894	17.2823 (90)
Living area fraction	fLA = Living area / (4) = 0.1036 (91)											
MIT	17.4806	17.7819	18.3043	18.9992	19.5693	19.9367	20.0713	20.0531	19.8083	19.1173	18.2357	17.4546 (92)
Temperature adjustment	-0.1500											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 17.3306 17.6319 18.1543 18.8492 19.4193 19.7867 19.9213 19.9031 19.6583 18.9673 18.0857 17.3046 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8949	0.8731	0.8345	0.7633	0.6549	0.5061	0.3627	0.3997	0.5990	0.7770	0.8653	0.9027	(94)
Useful gains	551.9471	581.7557	592.1110	576.3851	513.7564	387.6053	264.9564	275.6991	389.2860	473.7114	509.3340	533.9478	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1119.5789	1089.2958	992.8701	833.6632	646.8119	434.5997	278.2973	293.5306	465.7417	701.1098	920.5133	1106.9093	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	422.3181	341.0669	298.1648	185.2403	98.9932	0.0000	0.0000	0.0000	0.0000	169.1844	296.0491	426.2833	(98)
Space heating												2237.3002	(98)
Space heating per m2											(98) / (4) =	28.6100	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2472.1549 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	422.3181	341.0669	298.1648	185.2403	98.9932	0.0000	0.0000	0.0000	0.0000	169.1844	296.0491	426.2833	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	466.6498	376.8695	329.4639	204.6854	109.3848	0.0000	0.0000	0.0000	0.0000	186.9441	327.1261	471.0313	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320	(64)
Efficiency of water heater (217)m	89.6833	89.7364	89.8034	89.9309	90.1309	87.3000	87.3000	87.3000	87.3000	89.4086	89.5624	89.6923	(216)
Fuel for water heating, kWh/month	155.6533	114.9181	89.1287	42.9776	13.8121	0.0000	0.0000	23.5711	48.6361	94.4756	132.1482	154.7870	(219)
Water heating fuel used												870.1078	(219)
Annual totals kWh/year													
Space heating fuel - main system												2472.1549	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													377.9500 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =										-543.4106		-543.4106	(233)
Total delivered energy for all uses												3357.0943	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2472.1549	3.4800	86.0310	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	870.1078	3.4800	30.2798	(247)
Mechanical ventilation fans	55.2921	13.1900	7.2930	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	377.9500	13.1900	49.8516	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-543.4106	13.1900	-71.6759	(252)
Total energy cost			238.2670	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8123 (257)
SAP value			88.6688
SAP rating (Section 12)			89 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2472.1549	0.2160	533.9855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	870.1078	0.2160	187.9433	(264)
Space and water heating			721.9287	(265)
Pumps and fans	180.2921	0.5190	93.5716	(267)
Energy for lighting	377.9500	0.5190	196.1561	(268)
Energy saving/generation technologies				
PV Unit	-543.4106	0.5190	-282.0301	(269)
Total kg/year			729.6263	(272)
CO2 emissions per m2			9.3300	(273)
EI value			92.0641	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7900
Infiltration rate												0.2395 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2215 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2437	0.2271	0.2271	0.2160	0.2160	0.2049	0.2049	0.1938	0.1938	0.2105	0.2049	0.2160 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			5.4600	1.3258	7.2386		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	11.3800	78.6900	0.1900	14.9511	9.0000	708.2100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9316		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7605.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.2565 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0864 (36)					
Total fabric heat loss						(33) + (36) =	51.0180 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916	83.7916 (39)
Average = Sum(39)m / 12 =												83.7916 (39)
HLP	Jan 1.0715	Feb 1.0715	Mar 1.0715	Apr 1.0715	May 1.0715	Jun 1.0715	Jul 1.0715	Aug 1.0715	Sep 1.0715	Oct 1.0715	Nov 1.0715	Dec 1.0715 (40)
HLP (average)												1.0715 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3955 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-870.5009 (H17)
Solar input	-28.5766	-40.6341	-69.8403	-94.2308	-110.1318	-118.7419	-113.0330	-103.0222	-80.5017	-55.3617	-33.7986	-22.6280 (63)
Solar input (sum of months) = Sum (63)m =												-870.5009 (63)
Output from w/h	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981 (64)
Total per year (kWh/year) = Sum (64)m =												756.2498 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5027	47.5207	38.6464	29.2578	21.8706	18.4640	19.9510	25.9331	34.8074	44.1960	51.5832	54.9897 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	550.6132	545.8420	524.1334	490.8236	456.9206	426.7696	409.3942	418.0124	437.4283	470.9479	507.9692	535.7825 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				0.6000	14.6176	0.7200	0.7000		0.7700	3.0633 (75)		
Southeast				3.3300	45.1778	0.7200	0.7000		0.7700	52.5452 (77)		
Northwest				1.5300	14.6176	0.7200	0.7000		0.7700	7.8115 (81)		
Northwest				3.8000	14.6176	0.7200	0.7000		0.7700	19.4010 (81)		
Solar gains	82.8211	128.9573	201.5663	290.7831	341.5173	387.6379	354.1942	312.5332	242.7267	158.5931	100.7746	65.9282 (83)
Total gains	633.4342	674.7993	725.6997	781.6067	798.4379	814.4075	763.5884	730.5456	680.1550	629.5410	608.7439	601.7107 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129	25.2129
alpha	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809	2.6809
util living area	0.9206	0.9040	0.8627	0.7853	0.6570	0.4759	0.3466	0.3606	0.5908	0.7903	0.8886	0.9275 (86)
MIT	19.2703	19.4346	19.8133	20.2643	20.6719	20.9050	20.9717	20.9688	20.8190	20.3870	19.7700	19.2305 (87)
Th 2	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242	20.0242 (88)
util rest of house	0.9097	0.8909	0.8434	0.7540	0.6046	0.3987	0.2501	0.2609	0.5160	0.7518	0.8707	0.9173 (89)
MIT 2	17.7527	17.9866	18.5230	19.1472	19.6831	19.9511	20.0111	20.0096	19.8671	19.3277	18.4707	17.6971 (90)
Living area fraction	fLA = Living area / (4) = 0.1036 (91)											
MIT	17.9099	18.1366	18.6567	19.2629	19.7855	20.0499	20.1106	20.1090	19.9657	19.4374	18.6053	17.8559 (92)
Temperature adjustment	-0.1500											

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adjusted MIT 17.7599 17.9866 18.5067 19.1129 19.6355 19.8999 19.9606 19.9590 19.8157 19.2874 18.4553 17.7059 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8757	0.8551	0.8060	0.7198	0.5814	0.3882	0.2436	0.2539	0.4984	0.7171	0.8336	0.8843	(94)
Useful gains	554.6940	577.0399	584.9048	562.5814	464.2016	316.1895	186.0036	185.5031	338.9742	451.4565	507.4506	532.0833	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1035.6545	1012.7534	913.8882	763.5863	547.6233	335.1622	189.4161	189.2829	378.3777	610.6221	842.5482	1022.7551	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	357.8346	292.7995	244.7637	144.7236	62.0657	0.0000	0.0000	0.0000	0.0000	118.4192	241.2703	365.0599	(98)
Space heating												1826.9365	(98)
Space heating per m2										(98) / (4) =		23.3624	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2018.7144 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	357.8346	292.7995	244.7637	144.7236	62.0657	0.0000	0.0000	0.0000	0.0000	118.4192	241.2703	365.0599	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	395.3974	323.5353	270.4571	159.9155	68.5809	0.0000	0.0000	0.0000	0.0000	130.8500	266.5970	403.3810	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981	(64)
Efficiency of water heater (217)m	89.5985	89.6439	89.6942	89.8261	89.7925	87.3000	87.3000	87.3000	87.3000	89.1714	89.4512	89.6056	(216)
Fuel for water heating, kWh/month	151.1064	115.0739	88.5919	41.4618	18.9254	0.0000	0.0000	16.9068	43.6289	90.9436	126.8440	152.4436	(219)
Water heating fuel used												845.9263	(219)
Annual totals kWh/year													
Space heating fuel - main system												2018.7144	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													377.9500 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1149 * 1.00) =										-606.6838		-606.6838	(233)
Total delivered energy for all uses												2816.1991	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2018.7144	10.2300	206.5145	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	845.9263	10.2300	86.5383	(247)
Mechanical ventilation fans	55.2921	36.7200	20.3033	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	377.9500	36.7200	138.7832	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-606.6838	36.7200	-222.7743	(252)
Total energy cost			378.2650	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2018.7144	0.2160	436.0423	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

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Water heating (other fuel)	845.9263	0.2160	182.7201 (264)
Space and water heating			618.7624 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	377.9500	0.5190	196.1561 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	0.5190	-314.8689 (269)
Total kg/year			593.6212 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2018.7144	1.2200	2462.8316 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.9263	1.2200	1032.0301 (264)
Space and water heating			3494.8617 (265)
Pumps and fans	180.2921	3.0700	553.4969 (267)
Energy for lighting	377.9500	3.0700	1160.3065 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	3.0700	-1862.5192 (269)
Primary energy kWh/year			3346.1459 (272)
Primary energy kWh/m2/year			42.7896 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	97.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	262.19 (P1)
Transmission heat loss coefficient	51.02 (P7)
Summer heat loss coefficient	313.21 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
North West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	0.6000	106.0502	0.7200	0.7000	0.9000	25.9764
South East	3.3300	127.3119	0.7200	0.7000	0.9000	173.0727
North West	1.5300	106.0502	0.7200	0.7000	0.9000	66.2397
North West	3.8000	106.0502	0.7200	0.7000	0.9000	164.5170

total: 429.8058

Solar gains	Jun 465	Jul 430	Aug 371	(P3)
Internal gains	424	406	415	
Total summer gains	889	836	786	(P5)

Summer gain/loss ratio	2.84	2.67	2.51	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 97.3)	1.32	1.32	1.32	
Threshold temperature	19.56	21.29	21.13	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight